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Conflict of interests

The authors declare that there is no conflict of interest.

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Sequelae in children with severe SARS-CoV-2-related disease requiring Intensive Care: Description and comparison with other reasons for admission[☆]



Secuelas en niños con enfermedad grave vinculada a SARS-CoV-2 que precisaron Cuidados Intensivos: descripción y comparación con otros motivos de ingreso

To the Editor,

Currently, numerous studies have been published on the clinical characteristics and course of pediatric patients

admitted with COVID. It has been concluded that the severity associated with these patients lays in the manifestation as multisystemic inflammatory syndrome or in the existence of an underlying condition. However, the mid and long-term consequences have not been described in detail. On the other hand, ICU admission can have a tremendous impact on the patients' quality of life. The post-ICU syndrome refers to the existence of physical, cognitive and/or mental sequelae after the ICU admission. These sequelae persist beyond acute hospitalization and complicate transition to the patient's daily life.^{1,2} Therefore, it seems interesting to describe and be aware of the existence of mid and long-term sequelae after ICU admission due to SARS-CoV-2-related diseases whether post-ICU syndrome or persistent COVID after having suffered the severe forms of the disease.

This is a series of 31 patients between 0 and 18 years of age who had to be admitted to the intensive care setting due to COVID-19. All of them were assessed later at the pediatric intensive care unit (post-PICU) to detect possible complications associated with the disease or with the ICU admission (see electronic supplementary data).^{3–5} The study has been approved by Hospital Infantil Universitario Niño Jesús ethics committee in Madrid, Spain.

Twenty-eight out of the 31 patients of the series were diagnosed with pediatric inflammatory multisystemic syndrome (PIMS) in the SARS-CoV-2 setting. One of them presented with coronavirus-induced pneumonia, another

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Table 1 Clinical characteristics of patients admitted to the PICU.

	Overall patients (N = 93)	Non-COVID (N = 62)	COVID (N = 31)	P
Age (years), median (IQR)	9.54 (9)	8.67 (10.8)	9.61 (3.8)	.2
Sex (men), n (%)	55 (59%)	37 (60%)	18 (58%)	1
Underlying disease, n (%)	9 (9.6%)	7 (11%)	2 (6.5%)	.46
Inotropic support, n (%)	29 (31%)	12 (19%)	17 (55%)	.001
Invasive mechanical ventilation, n (%)	16 (17%)	14 (23%)	2 (6.5%)	.079
ICU stay (days), median (IQR)	6 (7.5)	7 (10)	5 (4)	.22
Hospital stay (days), median (IQR)	11 (12)	12.5 (19)	10 (4)	.41

In bold, statistically significant values.

one with SARS-CoV-2-related pneumococcal necrotizing pneumonia (with isolation of the latter in nasopharyngeal aspirate and pleural fluid). The last one was a teenager with systemic thrombosis (pulmonary thromboembolism, thrombosis of cerebral venous sinuses, and deep venous thrombosis of bilateral femoral and iliac veins towards the infrarenal inferior vena cava).

The median of days elapsed since hospital discharge until the next medical visit after the ICU stay was 40 days (range 9).

At discharge, all the patients could carry out activities of daily living except for 2, one of them a breastfed baby, and another one with pediatric cerebral palsy whose situation, however, had not become worse prior to the ICU admission.

Regarding the cognitive and physical sequelae, 13 patients complained of fatigue and generalized weakness that became exacerbated when doing physical exercise. Muscular weakness was confirmed in 4 patients. Only one girl had dyspnea (normal pulmonary function). None of them had nutritional problems or weight loss. A total of 18 patients had heart damage at admission (75% out of 28 kids examined) 4 out of whom still had it at hospital discharge (1 coronary ectasia, 1 interventricular septal dyskinesia, and 2 mild mitral regurgitations).

A total of 5 patients had problems going to sleep and/or keeping sleep, 16% of whom were co-sleeping after admission. Four of them had pain, but only 1 required analgesia at hospital discharge (in the polyneuropathy context of the critically ill patient).

No new-onset disability or neurological disorders were seen in any of the patients (measured using the Functional Status Score, and the Pediatric Cerebral Performance Category, respectively).⁶

Eight patients could not go to school when the medical visit took place (26%).

Psychosocial assessment was conducted by a psychologist who worked at the unit and who detected symptoms of anxiety, depression or acute stress after interviewing the patient and his family. Twelve out of the 29 patients studied had psychological symptoms (2 had symptoms of post-traumatic stress disorder, 7 had symptoms of anxiety, and 1 had depressive symptoms).^{4,7}

The children's quality of life was initially measured using the PedsQL scale, which was later modified to the KINDL questionnaire⁶ because it is easier to understand for both the children and their families. These scores assess the patient's quality of life through questions on their physi-

cal, emotional, social, and pedagogical wellbeing. Questions are answered by parents and patients >4–5 years independently, and the score is extrapolated to a scale from 0 to 100 being 100 the best possible quality of life. The median score was 83.4 when the kids answered (IQR, 10.1) and 75 when the parents answered (IQR, 24.8). The main problems posed by the parents were difficulty walking more than a block, running, doing exercise or lifting heavy weights, anger and irritability, and difficulty paying attention and finishing up the homework. Patients also complained of physical difficulties ruling out fatigue as the main symptom. They complained of difficulties while trying to keep up with their friends and being more forgetful, more preoccupied, and irritated more often.

The presence of family overload using the reduced Zarit Burden scale was assessed too, and confirmation data on family overload after admission in 6 out of 29 respondent families was found.

This group of patients was compared to the remaining patients who sought medical care after the ICU stay since February 2020. To conduct such comparison, only previously healthy patients or with conditions of outpatient follow-up such as asthma or scoliosis, among other, or with a disease or an acute event that required ICU admission were included (for a total of 62 patients).

The reason for admission in this group was polytrauma (26 patients), postoperative monitorization (14), septic shock (6), respiratory condition (6), new-onset brain tumor (3), and other conditions (7).

Both the clinical characteristics and the support received at the intensive care unit are shown on [Table 1](#) while evolution at hospital discharge is shown on [Table 2](#).

The physical, cognitive, and mental aspects were assessed, as well as the patients' quality of life and family overload looking for indicators suggestive of post-ICU syndrome in both groups, and specific sequelae associated with infection due to SARS-CoV-2 in patients admitted due to COVID-19.

Nearly 30% of all pediatric patients who require PICU admission have new-onset physical and/or psychological symptoms after admission. Although muscular weakness is found more often in patients with COVID-19,⁸ no significant differences were found regarding sleep, need for pharmacological treatment or hospital follow-up, psychological impact on the kid or his family, family overload or the patient's quality of life.⁹ Similarly, patients with COVID could go back to school before the other patients.

Table 2 Comparative analysis of clinical-evolutionary data of patients who went to medical visits after PICU admission.

	Overall patients (N= 93)	Non-COVID (N= 62)	COVID (N= 31)	P
Follow-up by specialists, n (%)	83 (89%)	55 (89%)	28 (90%)	1
New for pharmacological treatment, n (%)	31 (33%)	23 (37%)	9 (29%)	.494
Generalized weakness, n (%)	22 (24%)	9 (15%)	13 (42%)	.005
FSS scale, median score (IQR)	6 (0)	6 (0)	6(0)	.062
PCPC scale, median score (IQR)	1 (0)	1 (0)	1 (0)	.2
Psychological damage, n (%)	41 (44%)	29 (47%)	12/31 (39%)	.46
Reduced Zarit scale, median score (IQR)	12 (7.2)	12 (8)	11 (7)	.74
Co-sleeping after admission, n/total (%)	14/80 (18%)	10/55 (18%)	4/25 (16%)	1
Did not go to school when medical visit took place, n (%)	38 (41%)	30 (48%)	8 (26%)	.045
Patient quality of life scale, median score (IQR)	82.9 (14.7)	82.5 (14.5)	83.4 (10.1)	.37
Family quality of life scale, median score (IQR)	75.6 (21.1)	77 (17.8)	75 (24.4)	.82
Post-PICU syndrome in the patient, n/total (%)	25/79 (32%)	15/50 (30%)	10/29 (34%)	.62
Post-PICU follow-up medical visit, n/total (%)	39 (42%)	25 (40%)	14 (45%)	.66

In bold, statistically significant values.

In conclusion, evolution after hospital discharge in kids admitted to the ICU due to COVID-19 is similar to that of patients admitted due to other acute conditions being the presence of fatigue and weakness the only difference found with favorable progression in further medical visits.

Authors/collaborators

Inés Leoz, Jessica García, Consuelo Barbero, and Alba Alonso all contributed to data curation.

Inés Leoz, and Alberto García-Salido designed de study, analyzed the results, and drafted the manuscript.

All the authors contributed to the manuscript critical review process.

Conflicts of interest

None whatsoever.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.medin.2021.12.011>.

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